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Spermophilus mexicanus.

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Spermophilus mexicanus (Erxleben, 1777)

Mexican Ground Squirrel

[*Sciurus*] *mexicanus* Erxleben, 1777:428. Type locality restricted to Toluca, México, by Mearns (1896:1).
Spermophilus mexicanus Wagner, 1843:250.

CONTEXT AND CONTENT. Order Rodentia, Family Sciuridae, Genus *Spermophilus*, Subgenus *Ictidomys*. Two subspecies of *Spermophilus mexicanus* are recognized (Howell, 1938), as follows:

S. m. mexicanus (Erxleben, 1777:428), see above.
S. m. parvidens Mearns, 1896:1. Type locality Ft. Clark, Kinney Co., Texas.

DIAGNOSIS. The dorsum of *S. mexicanus* has nine rows of pale buff to whitish spots, which separates it from other species of the subgenus *Ictidomys*. The metaloph of P4 is not continuous as in ground squirrels of other subgenera of *Spermophilus*.

GENERAL CHARACTERS. Dental formula is i 1/1, c 0/0, p 2/1, m 3/3, total 22. The cheekteeth are narrowly triangular with high crowns and lophs. The pelage is dense and of moderate length. The dorsal color is variable, ranging from olivaceous gray to buffy brown with nine rows of squarish pale buffy to whitish spots (Fig. 1). The head is the same color as the dorsum except that the tip of the nose tends towards cinnamon to yellowish. There is a white orbital eye ring. The feet, sides, and underparts are white to pinkish buff (Davis, 1974; Mearns, 1896; Schmidly 1977). The tail is less than half the total length, flattened and slightly bushy, with a cylindrical base; "color grayish white, mixed with black, the lateral hairs twice banded with black, the outer band twice as wide as the inner" (Mearns, 1907). The ears are short and rounded, not rising above the crown; the antitragus is small. There are four or five pairs of mammae (Bryant, 1945).

The skull (Fig. 2) is of average size among members of the subgenus *Ictidomys* and lightly built. Bryant (1945) noted that, as in other members of the subgenus, the postorbital constriction is narrow, and the parietal ridges are prominent and meet at an acute angle well in front of the superior nuchal line. The external margins of the infraorbital foramina are usually slanted ventrolaterad, with horizontal bases, and the masseteric tubercles form pronounced elevations ventrolaterad to the foramina. The baculum was described by Bryant (1945) as being similar to that of *Spermophilus tridecemlineatus* and distinct from the baculum of another member of the subgenus, *Spermophilus spilosoma*.

Average (and extreme) external measurements (mm) of nine females of *S. m. parvidens* from Midland County, Texas (Edwards, 1946), are: total length, 320 (299 to 352); length of tail, 125.5 (108 to 134); length of hindfoot, 42.7 (39 to 46); length of ear from notch, 10.9 (8 to 12); weight, 254.4 (227.6 to 330.8) g.

Average (and extreme) external and cranial measurements (mm) of four males and four females of *S. m. parvidens* from Coahuila (Baker, 1956) are: total length, 301 (286 to 312), 283 (276 to 286); length of tail, 119 (106 to 127), 116 (115 to 120); length of hindfoot, 40 (38 to 42), 39 (37 to 40); length of ear from notch, 12 (11 to 14), 12 (11 to 13); greatest length of skull, 43.0 (42.5 to 43.5), 42.0 (41.1 to 42.8); palatilar length, 20.2 (20.1 to 20.3), 19.9 (19.7 to 20.1); zygomatic breadth, 25.4 (24.5 to 26.1), 23.9 (23.7 to 24.4); cranial breadth, 18.9 (18.6 to 19.3), 17.9 (17.8 to 18.1); least interorbital breadth, 9.6 (9.2 to 10.1), 8.8 (8.3 to 9.0); postorbital constriction, 13.5 (13.1 to 13.9), 12.6 (12.0 to 13.3); length of nasals, 14.8 (14.4 to 15.2), 14.5 (14.1 to 14.9); length of maxillary toothrow, 8.5 (8.3 to 8.6), 8.1 (7.9 to 8.3). Weights of three males averaged 186.6 (145.2 to 210.2) g and two nonpregnant females weighed 126.4 and 135.5 g.

Average (and extreme) external measurements (mm) of 10 specimens of the larger *S. m. mexicanus* from central México (Howell, 1938) are: total length, 349.6 (322 to 380); length of tail, 144.6 (124 to 166); length of hindfoot, 48.4 (46.5 to 51.0). Cranial measurements of 13 adults from the same area are: greatest length of skull, 49.0 (45.3 to 52.5); palatilar length, 23.5 (22.0 to 24.2); zygomatic breadth, 28.9 (27.0 to 30.3); cranial breadth, 20.4 (19.3 to 21.1); least interorbital breadth, 10.4 (9.6 to 11.1); postorbital constriction, 14.0 (13.2 to 14.8); length of nasals, 17.8 (15.8 to 20.1); length of maxillary toothrow, 9.8 (9.3 to 10.5).

Davis (1944) took specimens of what might be a third subspecies of *S. mexicanus* at Monte Río Frío, 10,500 ft. (about 3,230 m), in the state of México. He reported that they were noticeably darker than those from the floor of the Valle de México at Texcoco, and that the interpterygoid space and the width of the palate between the molars were distinctly narrower.

DISTRIBUTION. *Spermophilus m. mexicanus* occurs (Hall, 1981) in the Mexican states of Aguascalientes, Guanajuato, Hidalgo, Jalisco, México, Puebla, Querétaro, Tlaxala, and in the Distrito Federal (Fig. 3). *S. m. parvidens* occurs over a broader range, extending from the Mexican states of Coahuila (Baccus, 1979), Nuevo León, Tamaulipas, and Zacatecas (Baker et al., 1981) northward to southeastern New Mexico, and western and central Texas. In the latter state, it ranges north at least to Willbarger County (Dalquest, 1968) and east along the Gulf Coast at least to Refugio County (Davis, 1974). Anderson (1972) did not record the species from Chihuahua and doubted its reported occurrence in the vicinity of El Paso, Texas (see also Schmidly, 1977).

FOSSIL RECORD. Dalquest (1965, 1975) reported teeth of *Spermophilus*, possibly of *S. mexicanus*, from a late Pleistocene deposit in Hardeman County, Texas, and from a Blancan-age deposit in Crosby County, Texas. Dalquest et al. (1969) recorded modern remains of *S. mexicanus* found in Schulze Cave, Edwards Co., Texas, and an isolated tooth from layer C2 of that cave (approximately 9,310 BP). They suggested that the numerous records in the literature of *Spermophilus* sp. from various Pleistocene deposits in Texas might represent *S. mexicanus*. They further noted that the species was abundant in early Recent shelters of man and probably was utilized as food. Modern remains of this ground squirrel also have been reported from a site in the Mexican state of Hidalgo (Alvarez, 1964).

ONTOGENY AND REPRODUCTION. In *S. m. parvidens*, breeding occurs in late March to early April and lasts 1 to 2 weeks as reported by Davis (1974) and Edwards (1946). Davis

FIGURE 1. Photograph of Mexican ground squirrel (*Spermophilus mexicanus parvidens*) from Winkler County, Texas.

FIGURE 2. Dorsal, ventral, and lateral views of cranium, and lateral view of lower jaw of *Spermophilus mexicanus parvidens* (TTU 10279, male) from 15 mi. SW Roscoe, Nolan Co., Texas.

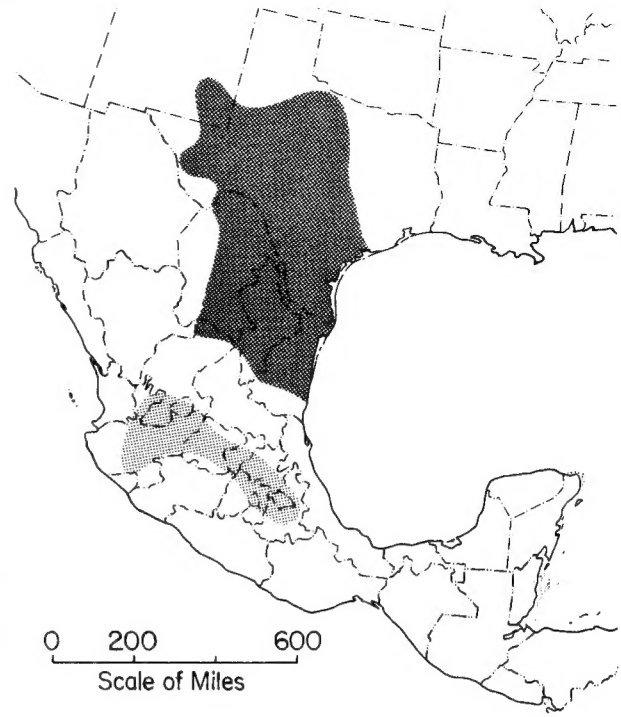

FIGURE 3. Distribution of *Spermophilus mexicanus*. Subspecies are distinguished by shading: *S. m. mexicanus* (pale), *S. m. parvidens* (dark).

(1944) noted that "as early as June 28 numerous half-grown young were observed at the Monte Río Frío locality suggesting that the breeding season there does not differ materially from that of the subspecies (*parvidens*) occurring in Texas." These squirrels seem to maintain constant pairs during the breeding period; the length of gestation is not known, although it probably is about 30 days (Davis, 1974). Edwards (1946) noted that males have descended testes from the end of March until mid-May. He recorded a pregnant female as early as 4 April, although parturition does not occur until May.

There may be one to 10 young per litter (average five). The young are born covered with fuzz, have vibrissae, are unpigmented, blind, have closed ears, forearms relatively well developed, and weigh from 3 to 5 grams. They are relatively helpless, but will cry out when handled or jostled. Average (and extreme) measurements (mm) of four young 12 hours after birth (Edwards, 1946) were: total length, 66.5 (63 to 69); length of tail, 13.9 (13.5 to 14); and length of hindfoot, 8.6 (8 to 9). Development is rapid and by August the young are able to lead an independent existence. Average (and extreme) measurements (mm) of nine immature animals taken in August (Edwards, 1946) were: total length, 275.9 (254 to 295); length of tail, 177.4 (110 to 122); length of hindfoot, 41.5 (40 to 43); and length of ear, 10.1 (10 to 11). The immatures occupy old burrows or refuge burrows. Young-of-the-year do not breed until the following spring.

Nothing is known of molt in this ground squirrel, but probably it resembles the pattern in *S. tridecemlineatus*. The latter has two adult pelages each year, molting from winter pelage to that of summer after emergence in spring and to winter pelage again in the late summer or early autumn prior to entering hibernation.

ECOLOGY. *Spermophilus mexicanus* inhabits level grasslands associated with mesquite (*Prosopis*), creosote (*Larrea*), and cactus (*Opuntia*). The species prefers sandy or gravelly soil, avoiding rocky areas, and has been found at elevations ranging from 210 to 3,230 m (Baker, 1956; Davis, 1944). Genoways and Jones (1973) reported taking specimens of *S. m. mexicanus* from La Mesa María de León, Jalisco, on a mesa that "had a parklike appearance—grasslands with scattered oak trees." In the vicinity of the San Carlos Mountains of Tamaulipas, Dice (1937) found the same subspecies "numerous in the mesquite association of the lower plains at El Mulato. At Tamaulipera, it was common in the . . . brush of the valley, where its burrows usually appeared under the large clumps of nopal cactus (*Opuntia*).

Blair (1940) recorded *S. m. parvidens* as most abundant in the mesquite-cholla association in the Davis Mountains. In Brewster County, Texas, Denyes (1956) reported this species as being most common, along with other species of ground squirrels, in tobosa (*Hilaria*)-burrograss (*Scleropogon*), tobosa-mesquite, and tobosa-opuntia associations. They were present but not common in shortgrass-*Yucca* and shortgrass-juniper associations. Herman (1950) noted that *S. m. parvidens* was found only on mesa tops of the Stockton Plateau in Terrell County, Texas, associated with a cedar-savannah habitat of *Juniperus*, *Agave*, and sotol (*Dasylirion*). The animals were not found in canyons or on mesa slopes where other species of ground squirrels were present.

The Mexican ground squirrel has adapted well to civilization, now occurring on cemeteries and golf courses, in gardens and cultivated fields, and in the short grass along highways (Edwards, 1946; Schmidly, 1977). Their burrows are not marked by a mound of dirt. An individual squirrel occupies more than one burrow, having an average of five escape burrows to every home burrow (the two types of burrows are indistinguishable externally).

Burrows have a diameter of 60 to 80 mm (Davis, 1974) and enter the ground at an angle of 30 to 50 degrees. They range in depth from 30 to 125 cm (the average depth of a home burrow is 50 cm, whereas a refuge burrow seldom exceeds that depth). Bailey (1932), Blair (1952), and Dice (1937) reported finding the majority of burrows at the base of mesquite bushes or clumps of prickly pear, whereas Edwards (1946) found only occasional burrows in these situations and the majority in the middle of grassy plots. He also observed that another favored site was between the tracks of little-used dirt roads.

Females build a brood chamber as an offshoot from the deepest portion of the main tunnel. The brood chamber is spheroid, about 180 to 200 mm in diameter, and contains a nest of grasses, and leaves and twigs of mesquite. After the young have left the burrow, the nesting material is removed to the sleeping area, and the brood chamber is filled in and not utilized again. Males, immature animals, and nonbreeding females simply enlarge a part

of the main tunnel to serve as a sleeping area. See Davis (1974) and Edwards (1946).

Refuge burrows are generally old main burrows that have been partially filled in, or they may be dug for that specific purpose; occasionally abandoned burrows of pocket gophers are used (Davis, 1944; Edwards, 1946). Escape burrows support numerous invertebrates, including spiders, beetle larvae, camel crickets (*Ceuthophilus*), and stink bugs (*Eleodes*). Edwards (1946) noted that the relationship between the Mexican ground squirrel and the stink bug was ". . . almost commensal. It would have been so had not the squirrels eaten so many of them. Adults, larvae (in the nest), and pupae were all found in the burrow or the earth surrounding the burrow."

The food habits of *S. mexicanus* vary seasonally. In early spring, the diet is composed of mesquite beans and leaves, which are the preferred food items, but individuals readily eat agarita (*Berberis*) leaves and berries, Shasta lily (*Aphonostephus*), Johnson grass (*Sorghum*), and pinclover (*Erodium*), as well as various cultivated grains (Davis, 1974; Edwards, 1946). Bailey (1932) reported that these ground squirrels occasionally climb into low bushes to forage for seeds and fruits. By early summer the diet is half composed of insect material. Edwards (1946) noted that he frequently saw squirrels chasing flies and other insects, and suggested that individuals eat all the insects they encounter in their burrows. Davis (1974) noted "they are fond of meat and frequently can be seen feeding upon small animals killed on the highways. In captivity they exhibit a cannibalistic tendency and kill and eat their cage mate."

Mammals found in association with *S. mexicanus* vary with locality. Edwards (1946) reported *Cynomys ludovicianus, Perognathus flavus, P. hispidus, Sylvilagus floridanus,* and *Lepus californicus*. Davis (1944) noted that *S. m. mexicanus* competed with *Cratogeomys merriami* for green vegetation and made use of their abandoned tunnels as escape burrows near Mexico City. Genoways and Jones (1973) reported the following animals as occurring in the same area with *S. m. mexicanus* in Jalisco: *Didelphis virginiana, Sylvilagus floridanus, Lepus callotis, Spermophilus variegatus, Perognathus flavus, Dipodomys phillipsii, Peromyscus boylii, P. maniculatis, P. melanophrys, Sigmodon hispidus, Neotoma albigula, Urocyon cinereoargenteus, Spilogale putorius,* and *Mephitis macroura*.

Doran (1955) and Eads and Hightower (1952) reported the only endoparasites as a "microfilaria" nematode and a spirachaete, both taken from individuals trapped in Texas. Edwards (1946) reported a species of flea (*Opisocrostis bruneri*) from animals he examined in Texas, and Whitaker and Wilson (1974) reported two mites, *Androlaelaps fahrenholzi* (Laelapidae) and *Ornithonyssus bacati* (Macronyssidae), also obtained from Texas specimens.

BEHAVIOR. The Mexican ground squirrel is somewhat colonial although it tends to be unsocial except during the breeding season. Individuals are not particularly aggressive and will tolerate considerable overlap of home ranges. However, they will not tolerate other squirrels in their home burrow or any other burrow occupied at that moment. The home range seldom exceeds 90 m in diameter and generally is half that size. The squirrels dig with their forelegs and push the dirt out of the burrow with kicks of the hindlegs. They are not particularly rapid excavators. These rodents have a specific defecation area outside their burrow. In captivity, females built better and more elaborate nests than did males, using less trash (Edwards, 1946).

There is some question as to whether these animals hibernate. Davis (1974) and Edwards (1946) reported that they do so, whereas MacClintock (1970) stated that they are active over the winter and do not hibernate. Schmidly (1977) reported that in Trans-Pecos, Texas, "activity of Mexican ground squirrels is curtailed by cold weather, and they seldom are seen during the winter," whereas Blair (1952) thought they remained active throughout the year in South Texas.

When alarmed these squirrels give a shrill whistled call. When in a defensive posture they lie on their side, hiss, and grind their teeth.

GENETICS. *Spermophilus mexicanus* has a diploid number of 34 chromosomes. The major karyological difference when compared with *S. tridecemlineatus* is in the size and centromeric position of the two smallest pairs of submetacentric autosomes. These pairs are relatively longer and the centromeres are more medial in *S. mexicanus*. A hybrid population of *S. tridecemlineatus-S. mexicanus* exists in the area of Hobbs, Lea Co., New Mexico. The hybrids are interfertile with both parental species although the degree of introgression is not yet known (Cothran et al., 1977; Nadler and Hughes, 1966; Zimmerman and Cothran, 1976).

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